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## (54) Apparatus for remotely monitoring an animal

(57) The apparatus, which may particularly monitor the onset of labour, comprises an insert 18 which is placed in the birth canal of the animal to be monitored and is retained in position by means 20 and a remote, separate monitoring station with which the insert communicates. A signal may be transmitted to such station when the temperature of the insert changes beyond a set threshold, e.g. when the insert is expelled by the animal. The insert preferably consists of a first component with a second component mounted thereon, the latter having a first reduced width state and a second expanded width state in which it provides said retaining means.

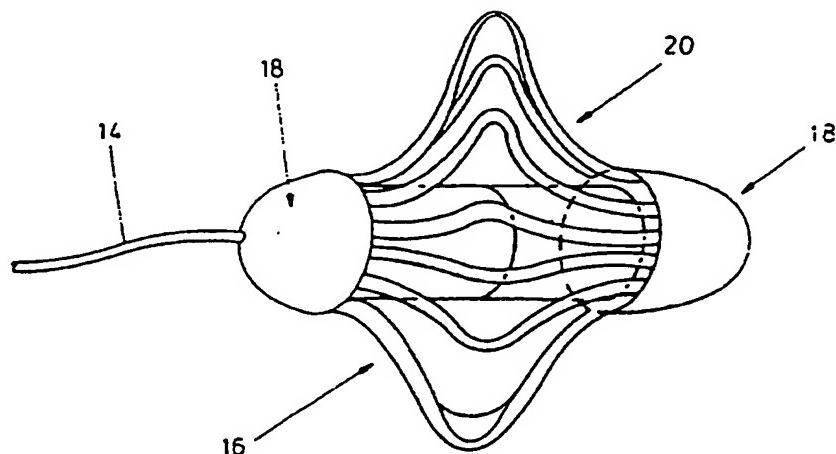


FIG. 3

GB 2 310 803 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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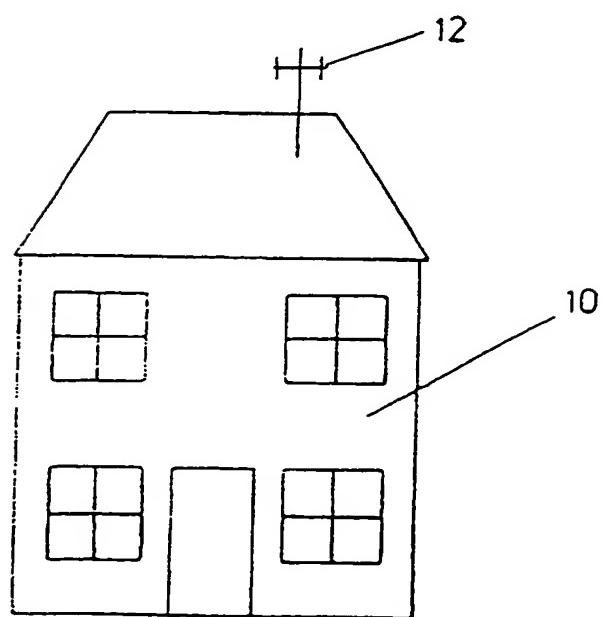
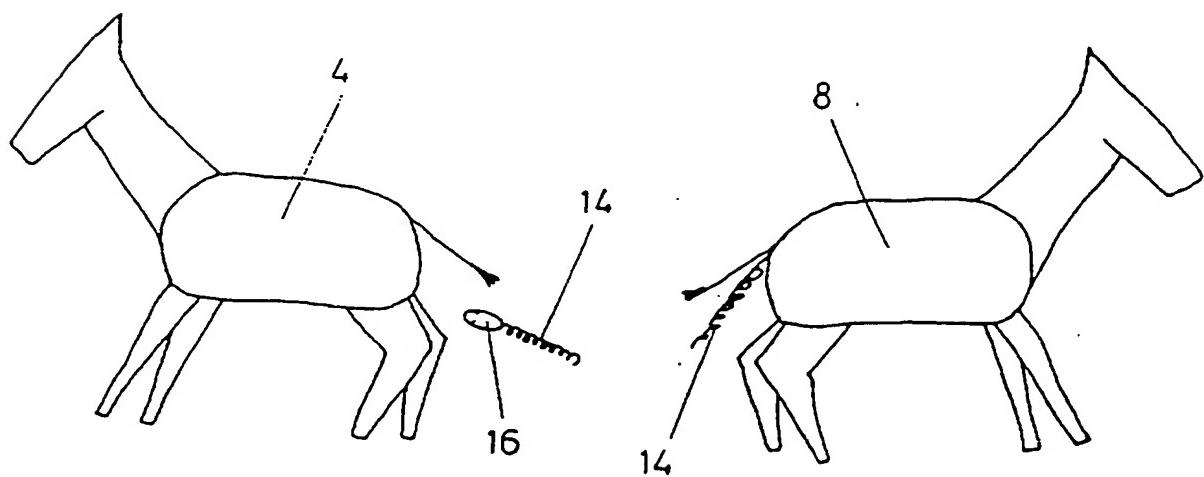
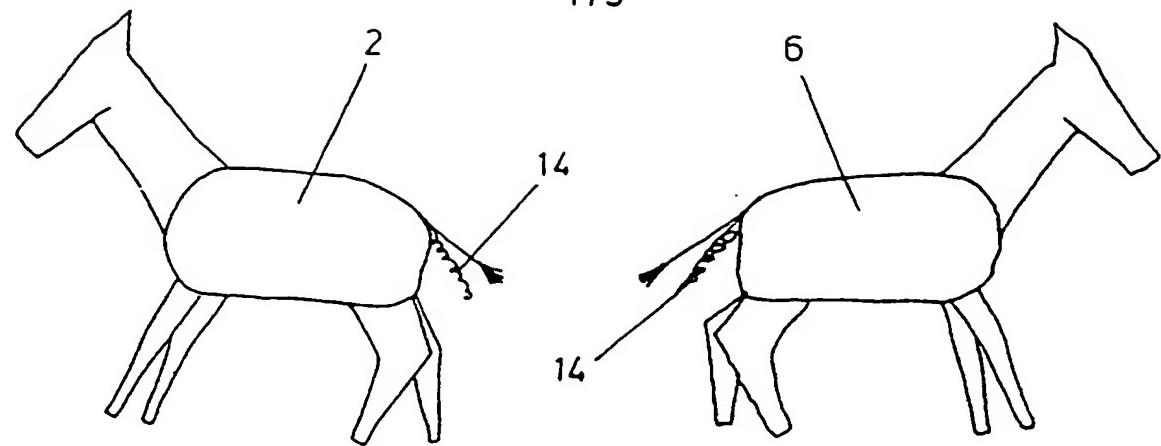


FIG. 1

-2/3-

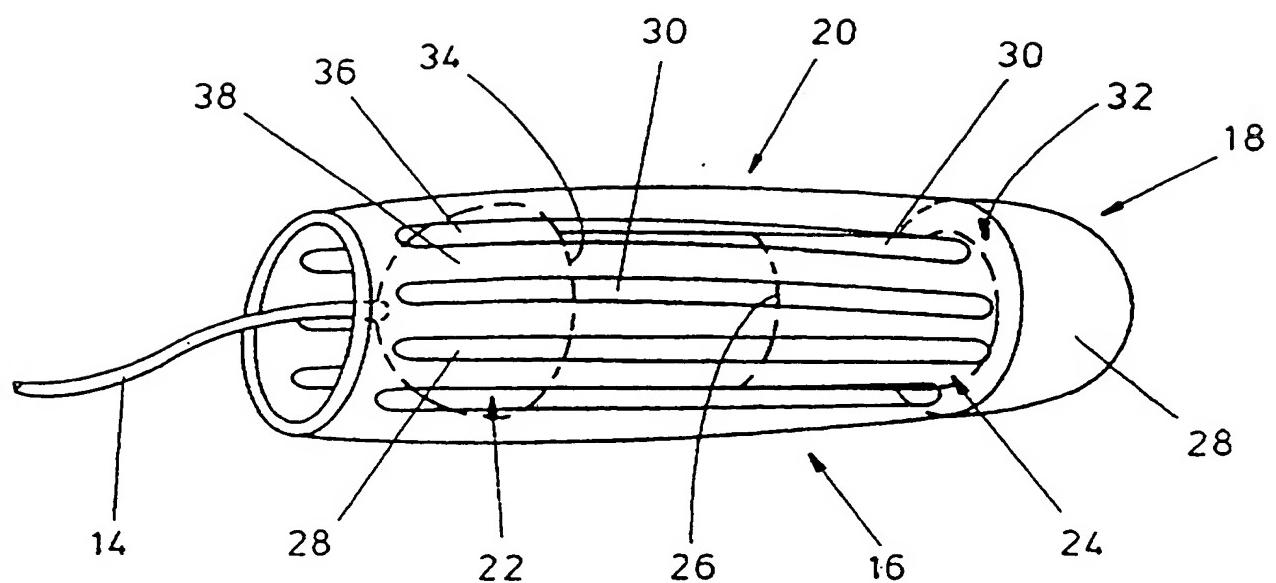


FIG. 2

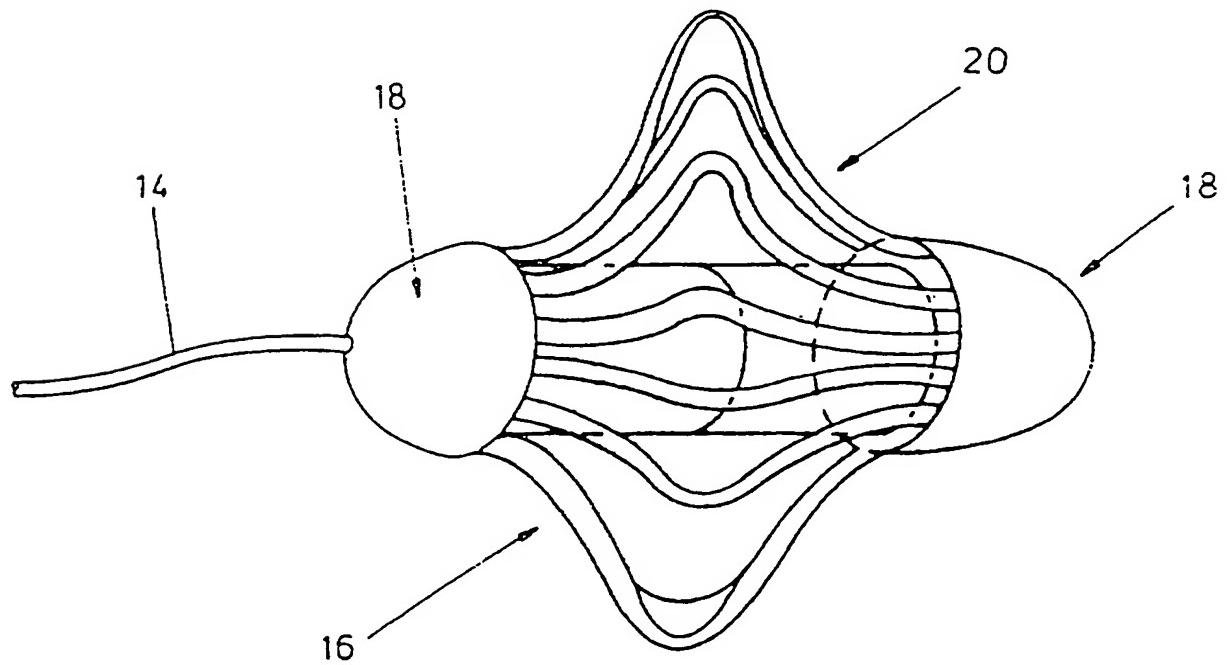


FIG. 3

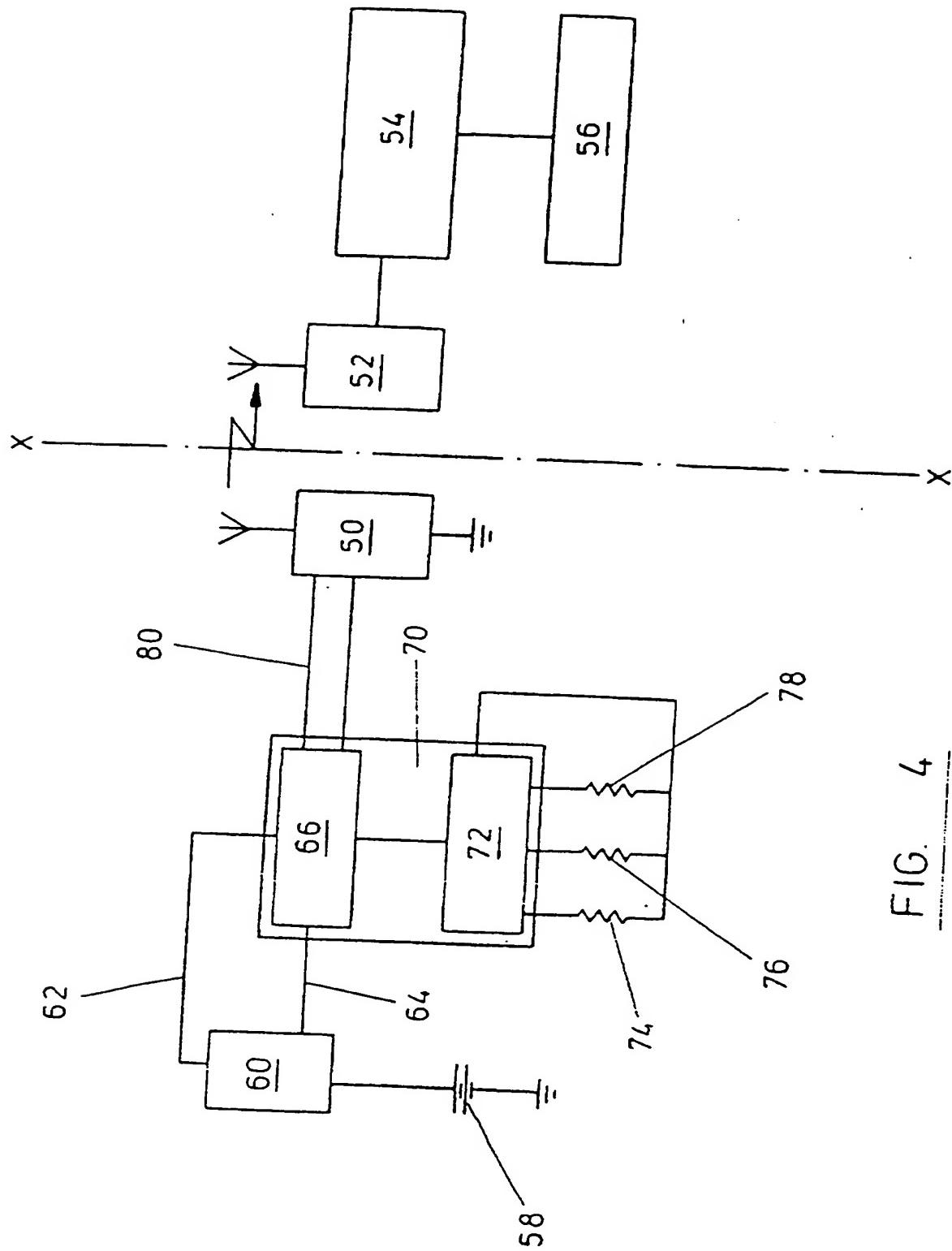


FIG. 4

## IMPROVEMENTS IN AND RELATING TO MONITORING

This invention concerns improvements in and relating to monitoring, particularly although not exclusively to the monitoring of animals prior to and during birth of offspring.

Unattended birth of offspring represents a significant problem in a variety of animal husbandry concerns. The presence of human assistance prior to, during and after birth is of prime importance both in assisting the birth itself and ensuring that no harm comes to either the parent or offspring during the procedure. Unattended birth can result in extreme distress or potential death of either parent and / or offspring which has severe financial implications for the parties concerned. Unfortunately, as birth is very difficult to predict with any degree of accuracy the presence of an attendant during a significant period of time is necessary.

The present invention aims to provide a system and apparatus for providing a remote indication of imminent birth. In this way suitable supervision of the birth can be provided whilst ensuring that the attendants are only present when absolutely necessary.

According to a first aspect of the invention we provide an apparatus for monitoring an animal, said apparatus comprising:-

monitoring means adapted to produce a signal indicative of the state of the animal; and

indicator means adapted to receive signal transmitted by the monitoring means and indicate status to the user.

In this way the condition of the animal can readily be monitored in a remote location without requiring the physical attendance of the user in close proximity of the animal.

The apparatus may comprise a first unit providing monitoring means, communication means and display means and second communication means being provided by a second unit. Control means to process the signals and/or control the display may be provided in the first and/or second unit. The control unit may be a microprocessor.

Preferably said monitoring means comprises an insert placed in the birth canal of said animal.

The insert may be in the form of a hollow container adapted to accommodate the monitoring and signal producing means. The insert or container may comprise one or more components releaseably joined together. In this way access to the internal workings of the device can be provided. A threaded engagement is preferred, most preferably with a flush external finish.

The insert preferably contains a power source and transmitter. A battery may be used as the power source. The power source may be rechargeable. The monitoring may be affected by monitoring of the temperature of the inserts environment. This may be achieved by the use of a thermistor. The temperature monitor may be provided within the device or may be attached to it.

The insert preferably consists of a cylindrical container, most preferably with rounded front and rear ends, most preferably in the form of hemispheres.

The insert may be smoothly profiled at each end but provided with a rib like transition between the end portion and cylindrical portion, the cylindrical portion being of reduced dimension relative to the step. This step may act as an abutment surface for use in fixing the insert within the birth canal. The step may be provided on a portion, or substantially round the whole of the circumference of the insert.

Suitable materials for producing the insert include inert plastics or polypropylene.

A trailing wire, lead or the like may be attached to the end of the insert. The lead may be between 30 and 45 cm long and most preferably 40 cm long, the tail may be formed of a suitable resilient material to which a load can readily be applied. This element may also contain the transmission aerial for the monitoring means.

The insert may be between 9 and 14 cm long and have a diameter of between 3 and 5 cm.

Preferably a second component assists in retaining the insert within the birth canal in use.

The second component preferably consists of an elongate

member having a width dimension.

The second component or fixing means preferably has a first reduced width dimension state and a second expanded width dimension state. Width being measured in any direction perpendicular to, or radially relative to the insertion direction. The width may be consistent around its circumference or the fixing means may extend preferentially in one or more width directions in the second state.

In a particularly preferred form of the invention the fixing means consist of a flexible tube provided with a series of longitudinal slots. The transition between the first and second stage may be affected by reducing the longitudinal distance between the end portions of the tube. In this way, by virtue of the slots, the strips between the slots expand outwards in a substantially radial manner to give the enlarged second state. The engagement between the limits of these strips and the wall of the birth canal may serve to retain the insert in position.

Preferably the leading edge of the fixing means is configured to cooperate with one or more abutment surfaces provided on the insert. Preferably in the second state the trailing edge of the fixing means engages with the further abutment surfaces provided towards the rear of the insert. This causes the fixing to be retained in the expanded state.

The fixing means may be made of suitable plastics material.

The fixing means may have a diameter of 3.5 to 5.5 cm, preferably 4.5 cm, in the reduced first state and a maximum diameter of between 10 and 12 cm in the second expanded state.

The insert, fixing means and / or receiving means may be portable.

The signal generated by the monitoring means may be conveyed to the receiving means by means of radio, optical, ultrasonic or microwave transmission. Radio transmission is a particularly preferred medium.

Preferably a signal is generated by one or more of the following events:-

temperature deviation from a predetermined range; absence of a sensor signal; failure or diminished power source power levels; and control means failure.

This ensures that the monitoring means is in a fully active and responsive state whenever in use. Any failure being indicated to the user. Preferably periodic checks are made on the system by the control means in the monitoring means. Signals may be periodically transmitted to the receiving means to indicate the monitoring means status. Preferably the omission or failure to receive a signal is indicated to the user. Two way communication may be provided.

Preferably the signal transmitted by the monitoring means is indicative of a particular monitoring means. In this way a plurality of monitoring means can be used with a single receiving unit, the source of the signal being indicated to the user. A plurality of alarms or other indications distinctive of a given monitoring means may be provided to assist in this regard. The display means is preferably capable of displaying or indicating more than one alarm activation or signal received at a time.

According to a second aspect of the invention, we provide a method of monitoring an animal, said method comprising the steps of:-

- a) providing monitoring means in contact with said animal;
- b) providing a remote receiver for signals generated by said monitoring means;
- c) said monitoring means generating a signal in response to a change in environment of said monitoring means; and
- d) said receiver indicating the receipt of the signal to the user.

This method thus provides a system for indicating to a user remote from the location of the animal the animals condition.

Preferably the monitoring means is inserted into the

animal, most preferably into the birth canal.

Preferably the signal arises as a result of the change in temperature of the monitoring means environment. In a particularly preferred embodiment the monitoring means is expelled from the birth canal and the temperature change arises as a result.

The device may be inserted using a suitable separate tool.

In a particularly preferred form the insertion method comprises providing the monitoring means in a first state, inserting the monitoring means to substantially the desired position within the birth canal and causing the monitoring means to assume a second state in which a portion of the monitoring means engages the birth canal of the animal, so restraining against withdrawal.

A particularly preferred embodiment of the invention provides a method in which slight withdrawal of the monitoring means causes fixing means attached thereto to move relative to a part of the monitoring means and so expand to an enlarged engaging state or diameter.

Various embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings in which:-

Figure 1 shows a schematic illustration of the embodiment;

Figure 2 illustrates the first embodiment of the invention in a first state;

Figure 3 illustrates the embodiment of Figure 2 in a second expanded state; and

Figure 4 illustrates a schematic provision of the circuitry.

As illustrated in Figure 1, the system of the present invention can be used to remotely monitor a number of animals (2, 4, 6, 8) from a remote location (10), such as the attendants living accommodation. A significant number of animals can be monitored by a single receiving means ie 16. A suitable receiver (12) is schematically provided at the remote location (10) and allows monitoring by the receiving means of

a plurality of devices inserted in the animals. The receiving means may have their own integral power supply, such as a battery. This may replace or supplement mains power supply. The receiving means is preferably hand held or portable. A pocket sized device is particularly preferred.

The monitoring means, described in more detail below, are inserted into the animal to be monitored when desired. In the case of a pregnant animal, to monitor the approach of birth, the device is most conveniently inserted a few hours before birth is expected.

The monitoring means can be inserted into the birth canal of the animal by using any suitable insertion device, such as a speculum inserter. Ideally the monitoring means are located just below the cervix of the animal.

Throughout the monitoring period the indicator means remain inside the animal. A signal indicative of the monitoring means state is transmitted at regular intervals to the receiving means of the remote location. Any system failures or loss of contact is thus indicated to the user. Clear transmission is provided by trailing an aerial (14) from the device.

When parturition occurs the amniotic sack of the animal breaks up and this, or the animal offspring itself moving in the birth canal, pushes the indicating means along the birth canal and expels it from the animal. This stage is illustrated with regard to animal (4).

Upon leaving the animal the indicator means (16) experiences a change of environment in this case in the form of a drop of temperature. This change in environment is detected by the indicator means and a signal is transmitted as a response to the remotely located receiving means. This "alarm" style signal prompts the remote attendant to attend the animal and monitor the birthing process.

As part of the alarm signal, the device (16) provides a unique signal indicative of which device in question has been expelled. Thus the attendant is able to identify the particular animal (4) for which attention is required.

Means may be provided in association with the receiving unit to record the identity of an animal associated with a given insert. Means to input this information to the receiving unit control means may be provided.

The system can be used to monitor cows, horses, pigs and indeed any other animal for which monitoring of this type is required.

Whilst the system has been described in particular, with regard to the monitoring of temperature, other environmental conditions such as pressure, humidity, vibration or indeed movement itself can be monitored.

Equally, whilst the device has been described for the use in monitoring of parturition other applications, such as the general measurement of temperature or other conditions within the animal, for instance, for fertility purposes can be employed.

A particular embodiment of the monitoring means is illustrated in Figures 2 and 3 in a state to be inserted and in the retaining state when located in the birth canal.

The device comprises an insert (18) and retaining means (20). Of course other shapes for the insert such as egg-shaped, and ovoid are possible.

In the relaxed state designed for insertion in Figure 2 the locating means (20) are movably located relative to the insert (18). The insert consists of two components (22, 24) connected at a relatively central location (26) or at an end location. The connection may be a threaded connection and is designed to provide a smooth exterior finish. Each of the halves (22, 24) consist of a head portion (28) of generally hemispherical form with a recessed cylindrical portion (30) provided between the two hemispheres (28). The recessed nature of the cylindrical portions (30) defines a first abutment surface (32) on the rear of the hemisphere on portion (24) and a second abutment surface (34) on the opposing portion of the rear of the hemisphere (28) of the other portion (22). These abutment surfaces extend around the entire perimeter of the cylindrical portions (30). The retaining means (20) consists

of a tubular element of relatively flexible material, such as plastic tubing, which is provided with a series of longitudinally arranged slits (36) defining strips (38) between them. In the position before insertion the tube (20) is pushed up against abutment surface (32), but extends back over the rear hemisphere (28).

A cord (14) which also contains the transmission aerial extends from the rear of the back portion (22).

In use, the device is inserted into the birth canal of the animal in question in this relaxed first state. Once in the desired position the rear hemisphere (28) is moved relative to the retaining means (20) by a sliding action. This sliding action can be affected by a rearward movement of the insert or a forward movement of the retaining means, or indeed a combination of both. The sliding movement causes the retaining means (20) to advance from the position shown in Figure 2 to that shown in Figure 3. The slot and strip nature of the majority of the tube causes it to expand radially in all directions to a relatively even extent, with the width of the slits (36) expanding. The diameter of the retaining means increases significantly as a result. In the expanded state Figure 3 the retaining means cooperate with the walls of the birth canal and retain the device in position.

The material making up the strips (38) is sufficiently flexible that the amniotic sack or animal during birth are able to deform the strips to a sufficient extent to allow the expulsion of the device from the birth canal.

The temperature sensor in the form of a thermistor closely monitors the environment of the birth canal by virtue of being attached to the inside wall of the insert.

The thermistor responds rapidly on expulsion due to the rapid cooling of the housing resulting from latent heat of vaporisation.

Figure 4, schematically illustrates the insert and monitoring means circuitry. The circuitry to the left of line XX represents the insert with that to the right the monitoring means; the distance between the transmitter (50) and receiver

(52) is bridged by the transmitted signal. The signal received at receiver (52) is processed by a micro controller (54) which presents on display means (56) the information supplied. The display means may provide an indication of the identity of the insert unit and / or signal low battery warning, fault warning, high temperature indication and low temperature indication. These displays may be provided visually or audibly or both. In particular, the low temperature warning may be provided as an audible alarm.

The insert is provided with a battery (58) or other suitable power source. A voltage converter and level comparator unit (60) monitors the power source and provide a power output (56) of the desired level. A low battery signal (64) may be sent to the logic and software (66) of the micro controller (70) in the event of the battery failing or diminishing. The analogue to digital convertor and multiplexer (72) monitors both the low (74) and high (76) temperature reference resistors and also the behaviour of the temperature sensor (78) itself. The analogue signals produced are converted to digital signals before processing and transmission. The logic (66) and preprogrammed software provided periodically analyses the received signals. Analysis of the signals is thus provided. If necessary, by means of serial data modulation provided to transmitter (50), the transmitter conveys the signal to the receiver (52) of the remote unit. Power for transmission is provided by line (80).

CLAIMS

1. Apparatus for monitoring an animal, said apparatus comprising monitoring means adapted to produce a signal indicative of the state of the animal and indicator means adapted to receive signal transmitted by the monitoring means and indicate status to the user, wherein the monitoring means is provided in an insert provided in the birth canal of the animal in use, the signal being produced by a change in temperature of the inserts environment upon leaving the birth canal, the insert comprising a first component with a second component mounted there on, the second component consisting of an elongate member having a first reduced width dimension state and a second expanded width dimension state, in which the transition between the first and second state is affected by reducing the longitudinal distance between the end portions of the second component.

2. Apparatus for monitoring an animal, said apparatus comprising:-

monitoring means adapted to produce a signal indicative of the state of the animal; and  
indicator means adapted to receive signal transmitted by the monitoring means and indicate status to the user.

3. Apparatus according to claim 1 or claim 2 in which the apparatus comprises a first unit providing monitoring means, communication means and display means and a second unit providing second communication means.

4. Apparatus according to claim 2 or claim 3 in which the monitoring means comprises an insert place in the birth canal of said animal.

5. Apparatus according to any of claims 1 to 4 in which the insert is in the form of a hollow container adapted to accommodate the monitoring and signal producing means and

optionally a power source and transmitter.

6. Apparatus according to any preceding claim in which the insert is smoothly profiled at each end but provided with a rib like transition between the end portion and a cylindrical portion, the cylindrical portion being of reduced dimension relative to the step.

7. Apparatus according to any of claims 2 to 6 in which a second component assists in retaining the insert within the birth canal in use.

8. Apparatus according to claim 7 in which the second component consists of an elongate member having a first reduced width dimension state and a second expanded width dimension state.

9. Apparatus according to claim 7 or claim 8 in which the second component consist of a flexible tube provided with a series of longitudinal slots.

10. Apparatus according to any of claims 7 to 9 in which the transition between the first and second stage is affected by reducing the longitudinal distance between the end portions of the tube.

11. Apparatus according to any of claims 7 to 10 in which the leading edge of the fixing means is configured to cooperate with one or more abutment surfaces provided on the insert.

12. Apparatus according to claim 11 in which in the second state the trailing edge of the fixing means engages with a further abutment surface provided towards the rear of the insert.

13. Apparatus according to any preceding claim in which a trailing wire, lead or the like is attached to the end of the

insert.

14. Apparatus according to any preceding claim in which a signal is generated by one or more of the following events:-  
temperature deviation from a predetermined range;  
absence of a sensor signal;  
failure or diminished power source power levels; and  
control means failure.

15. Apparatus substantially as described herein and/or with reference to the accompanying drawings.

16. A method of monitoring an animal, said method comprising the steps of:-

- a) providing monitoring means in contact with said animal;
- b) providing a remote receiver for signals generated by said monitoring means;
- c) said monitoring means generating a signal in response to a change in environment of said monitoring means; and
- d) said receiver indicating the receipt of the signal to the user.

17. A method according to claim 16 in which the monitoring means is inserted into the birth canal of the animal.

18. A method according to claim 16 or claim 17 in which the signal arises as a result of the change in temperature of the monitoring means environment when the monitoring means is expelled from the birth canal.

19. A method according to any of claims 16 to 18 in which the insertion method comprises providing the monitoring means in a first state, inserting the monitoring means to substantially the desired position within the birth canal and causing the monitoring means to assume a second state in which a portion of

the monitoring means engages the birth canal of the animal, so restraining against withdrawal.

20. A method according to claim 19 comprising a method in which slight withdrawal of the monitoring means causes fixing means attached thereto to move relative to a part of the monitoring means and so expand to an enlarged engaging state or diameter.

21. A method of monitoring an animal substantially as herein described, with reference to the accompanying drawings.



The  
Patent  
Office

14

Application No: GB 9704744.3  
Claims searched: 1-21

Examiner: L.V.Thomas  
Date of search: 28 May 1997

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): A5K (K6)

Int CI (Ed.6): A61D 17/00

Other: -

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2257886 A (Ratcliffe) see p.2 l.8 - p.4 l.14 and p.7 ll.3-26	2,3,16
X	GB 2077593 A (New Mexico State Univ.) see p.1 ll.48-61 and p.1 l.113 - p.2 l.43	2,4,5,7,8, 16,17,19
X	GB 1558330 (Lorette) see p.1 ll.74-91, p.2 ll.83-109 and p.4 ll.11-33	2-4,13
X	EP 0353681 A1 (Sonodyne) see col.2 l.39 - col.3 l.7 and col.3 l.29 - col.4 l.23	2,3,5,16
X	EP 0108330 A1 (Weiland) see WPI abstract Acc. No. 84-128754	2,4,7,14
P,X	WO 96/33669 A1 (Ultratec) see whole document	2,5,6,16
X	US 4651137 (Zartman) see col.5 ll.8-49, col.6 ll.17-46 and col.6 l.65 - col.7 l.15	1-5,7- 10,14,16- 19
X	US 4319583 (Ingle) see col. 1 ll.28-54 and col.3 ll.28-45	2,3,16
X	US 4232686 (Kammlade) see col.1 l.56 - col.2 l.13 and col.4 ll.11-32	2,3,16

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